

Determination of Bromide in NADP/NTN Wet Deposition Samples and its Spatial and Temporal Correlation with North American Mercury Wet Deposition

Christopher Lehmann, Lee Green,
Tracy Dombek, and David Gay



National Atmospheric
Deposition Program



ILLINOIS STATE
WATER SURVEY
PRAIRIE RESEARCH INSTITUTE

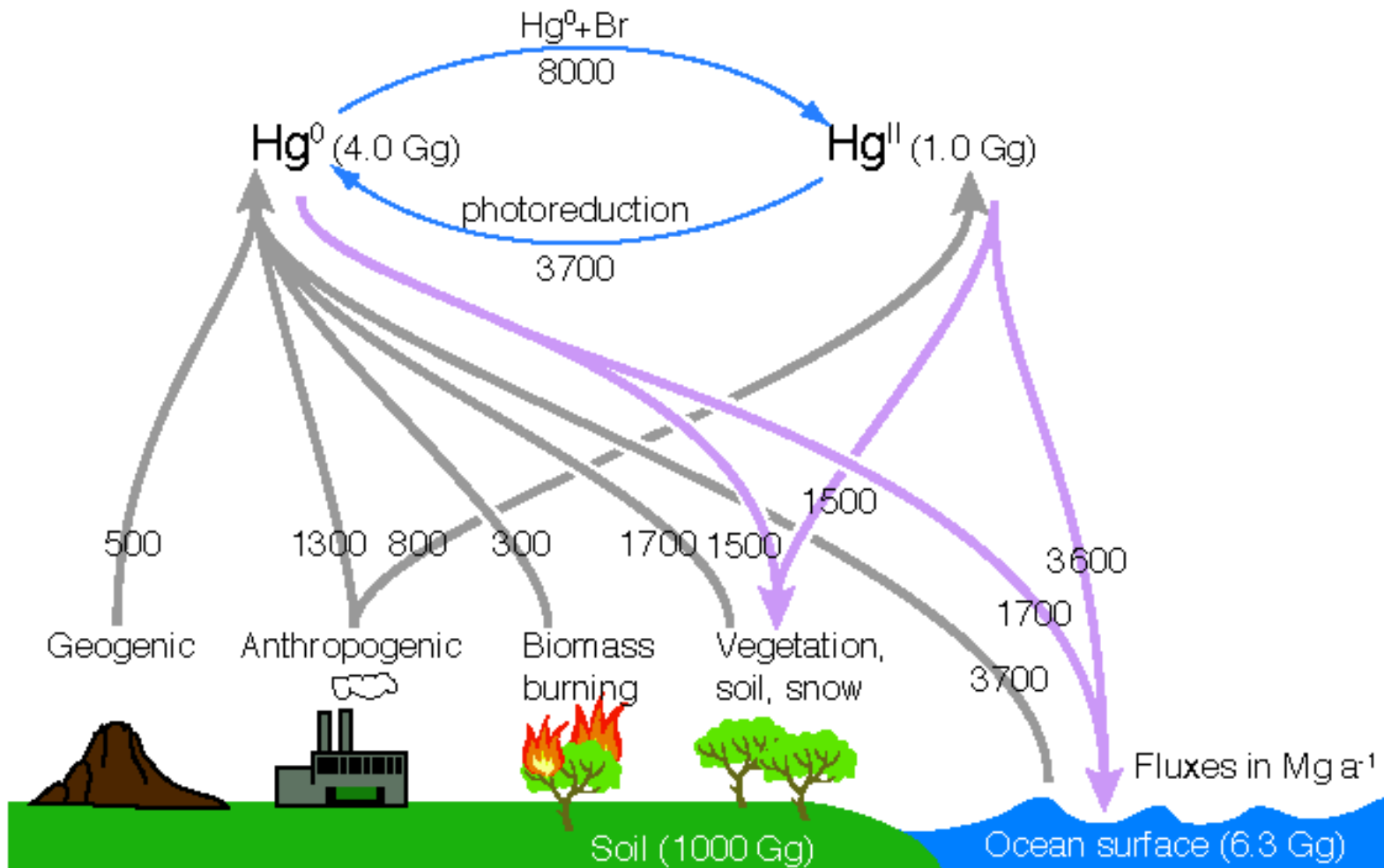
Introduction/Motivation

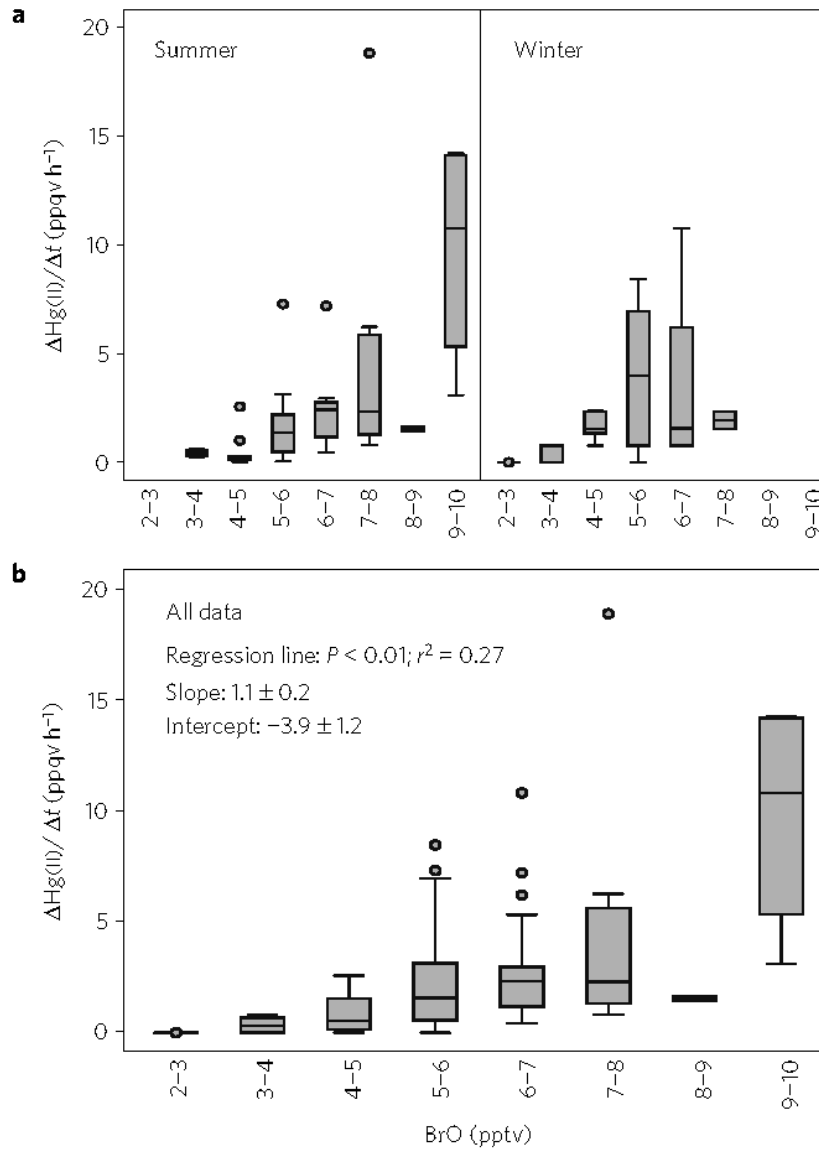
- NADP has approved bromide ion as a new analyte for NTN & AIRMoN samples
- What can we learn from this new data set?
- AT FIRST GLANCE – Bromide measurements seem to be a waste of time and resources, as it is only quantifiable in 20% of samples.....

Introduction/Motivation

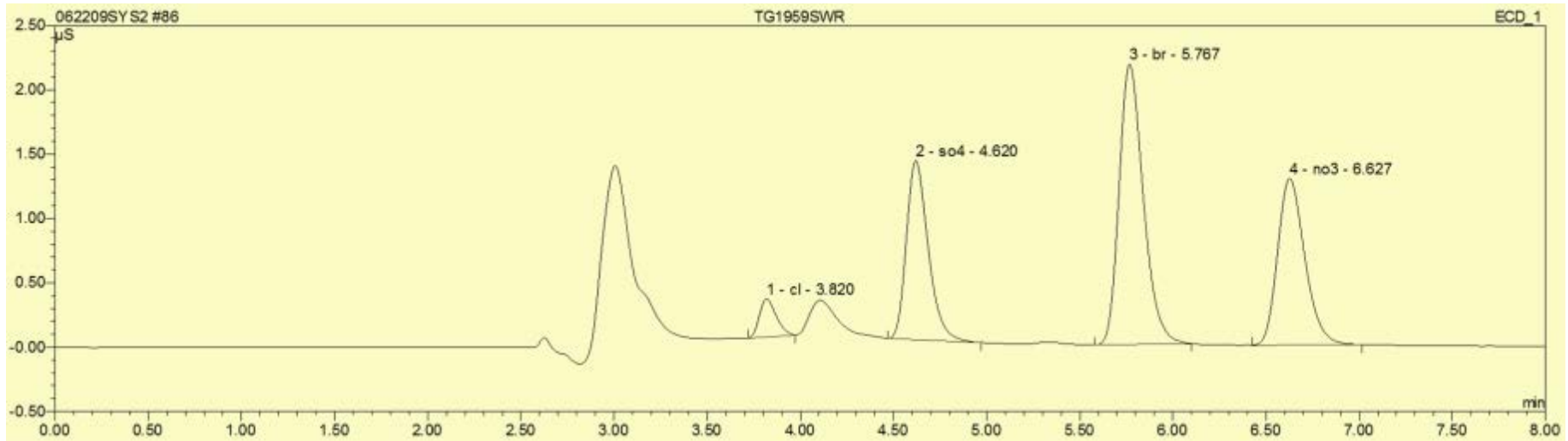
- NADP has approved bromide ion as a new analyte for NTN & AIRMoN samples
- What can we learn from this new data set?
- But...after further consideration...Bromide ion concentrations display “interesting” spatial and temporal trends, and correlate with other NADP measurements (e.g. Hg)

Oxidation of Mercury by Bromine





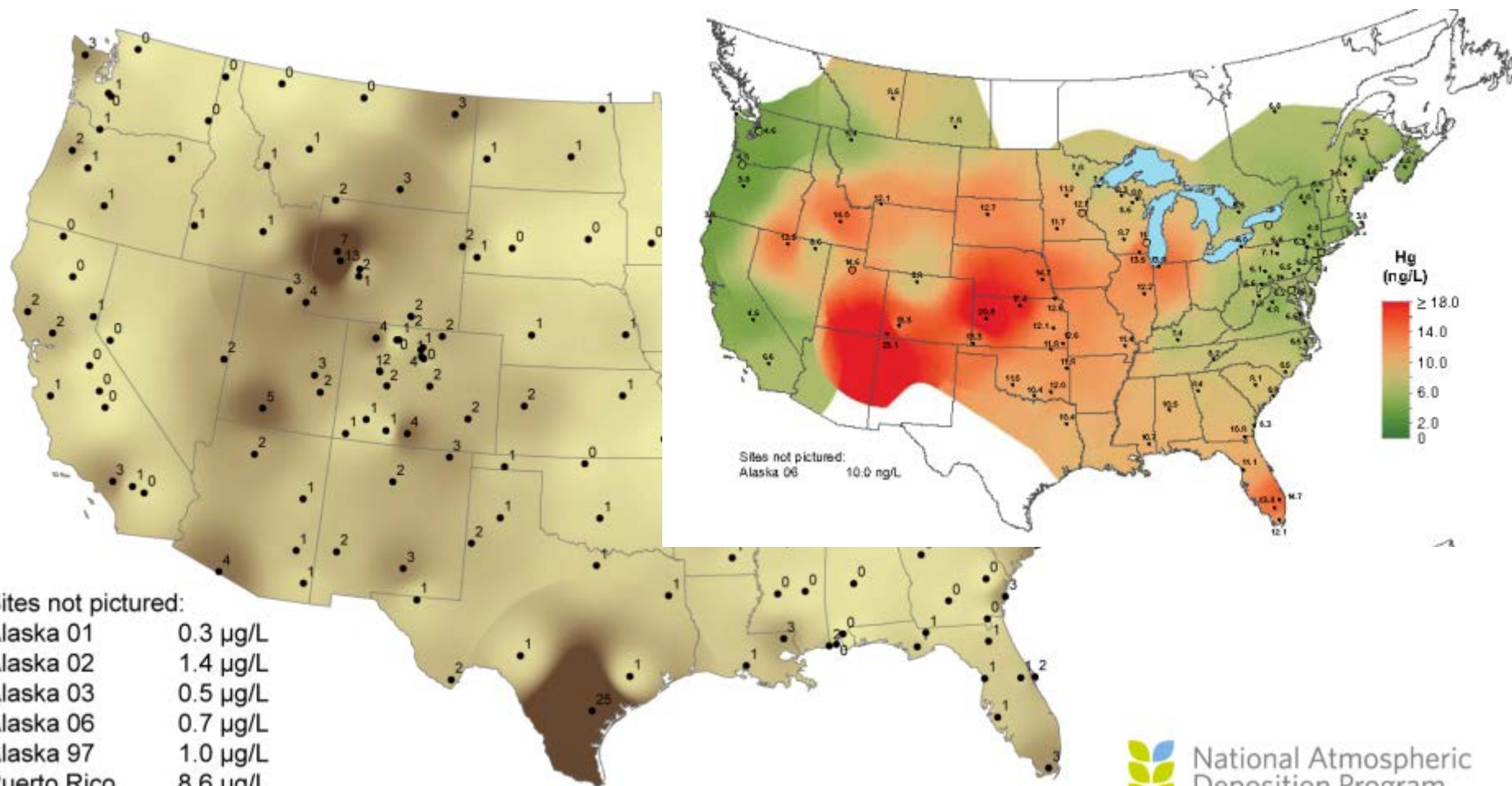
IC chromatograph



	Linear Range	R ²	MDL
Bromide	0 – 4.0 ppm	99.9%	0.003

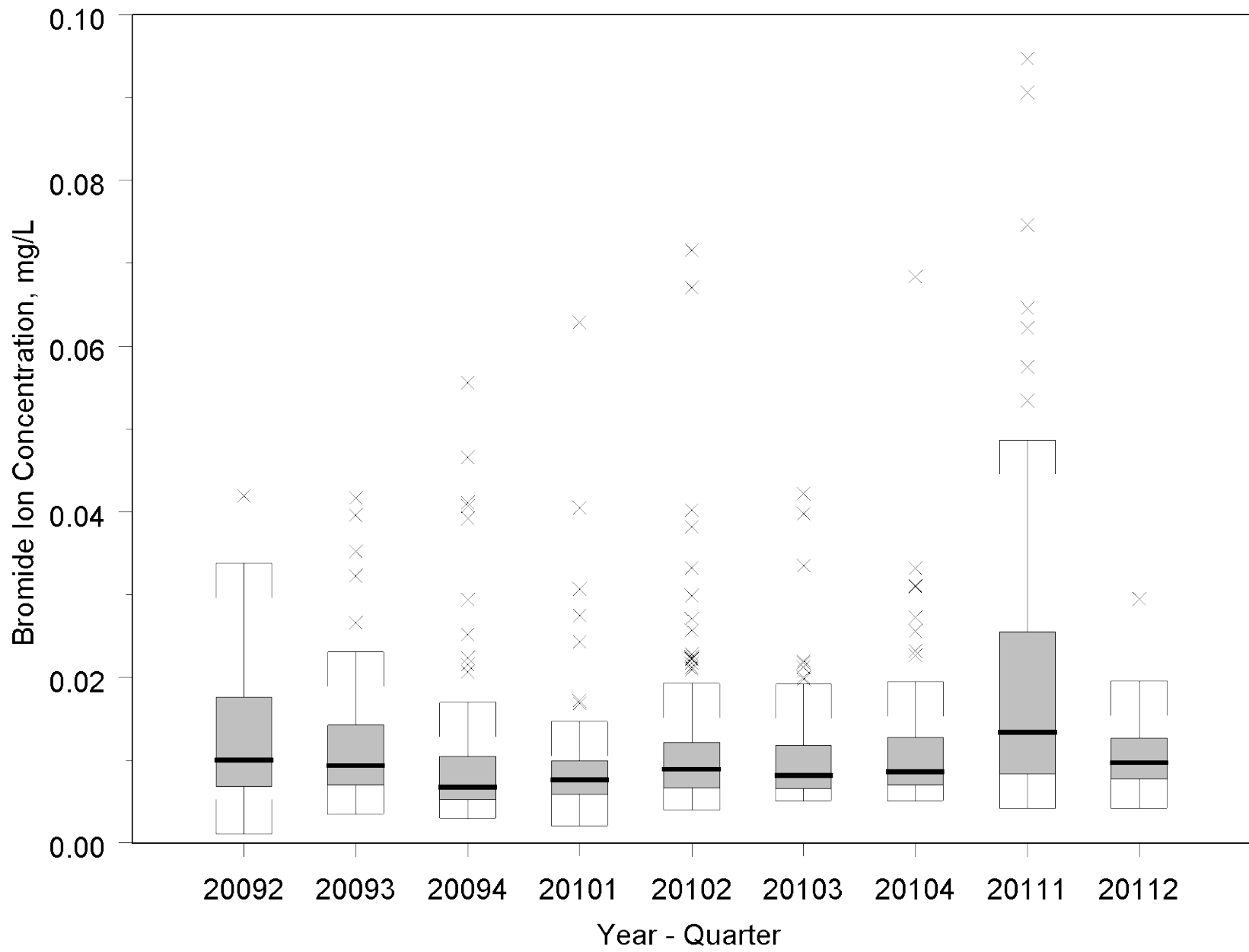
- MDL was determined from 10 ppb Br standard data
- Bromide quantified in all NADP/NTN & AIRMoN samples since June 2009
- Additional NTN archive samples were evaluated from 2001 – 2004 with funding for consumables provided by the USGS

Bromide Ion Concentration ($\mu\text{g/L}$), 2010

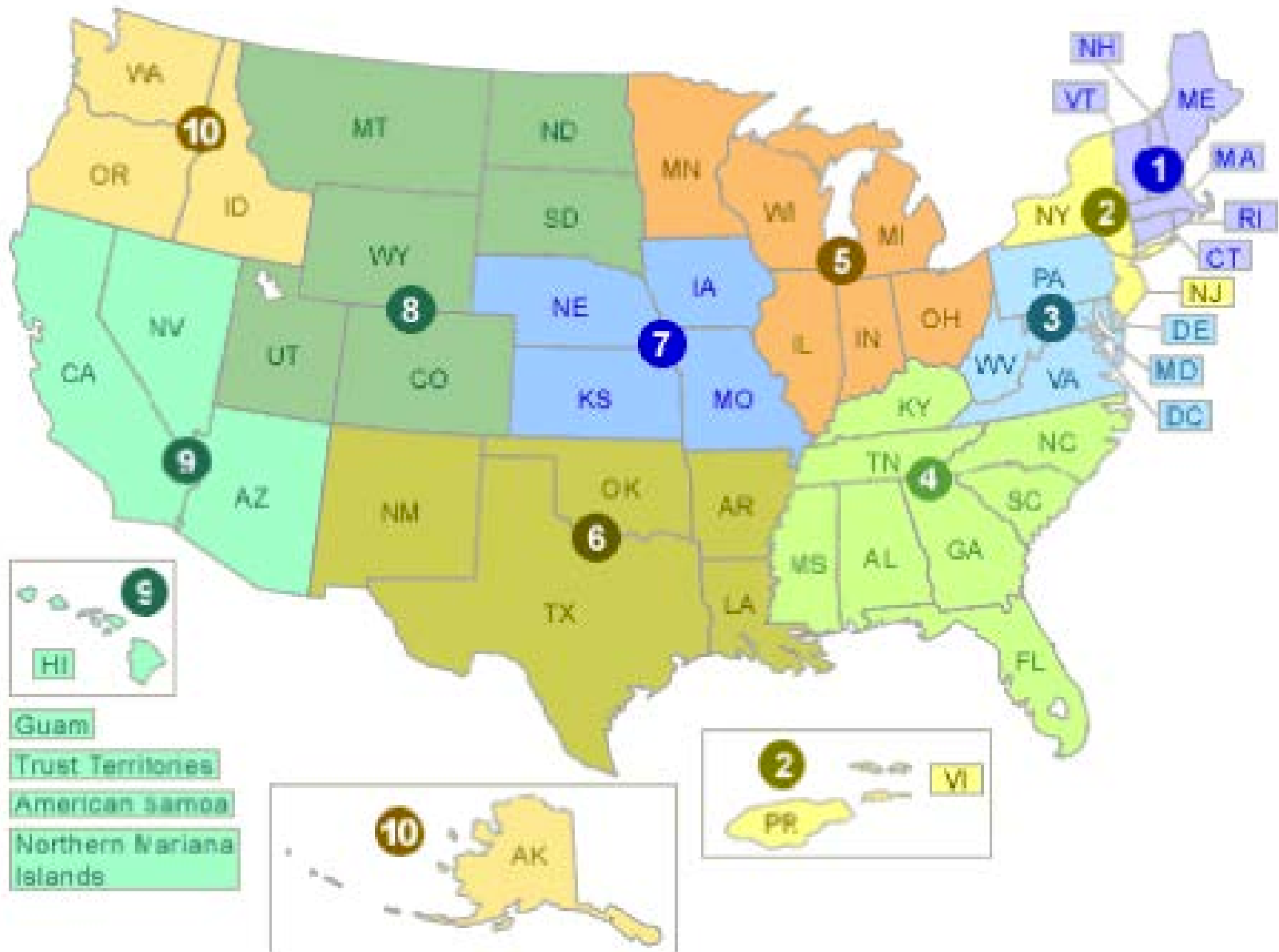


Sites not pictured:

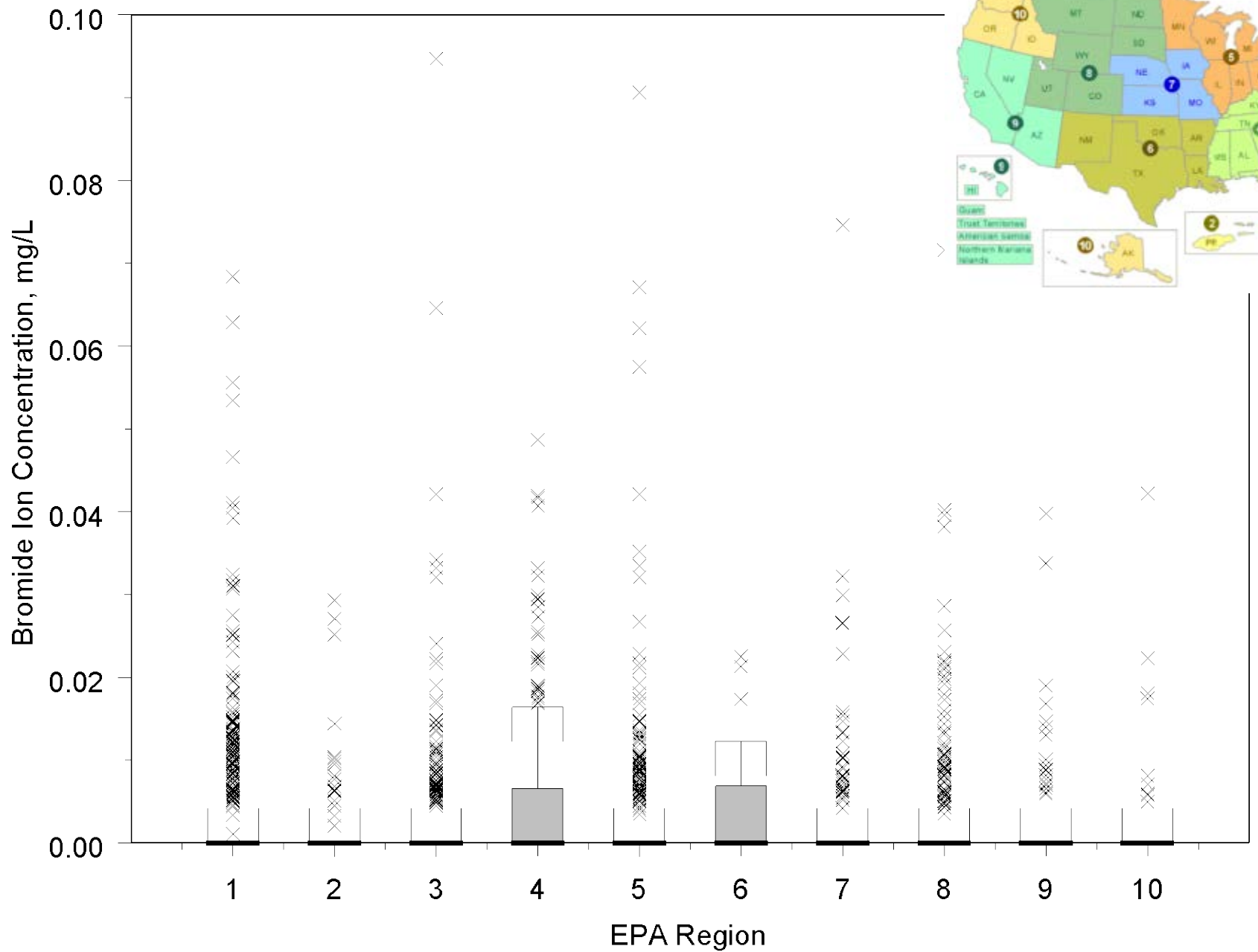
Alaska 01	0.3 $\mu\text{g/L}$
Alaska 02	1.4 $\mu\text{g/L}$
Alaska 03	0.5 $\mu\text{g/L}$
Alaska 06	0.7 $\mu\text{g/L}$
Alaska 97	1.0 $\mu\text{g/L}$
Puerto Rico	8.6 $\mu\text{g/L}$
Virgin Islands	13.2 $\mu\text{g/L}$



Map Of EPA Regions



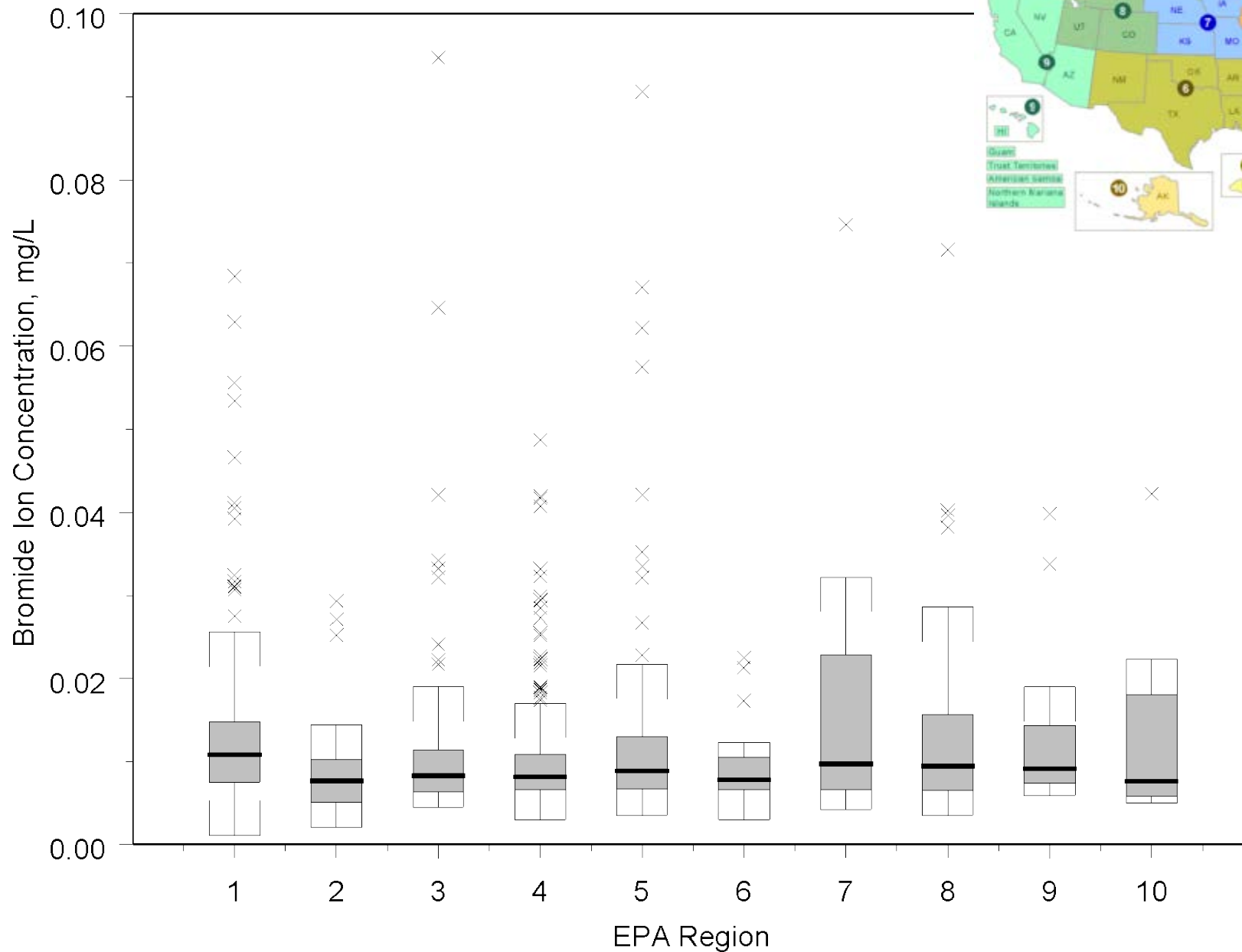
All data (including n.d.)

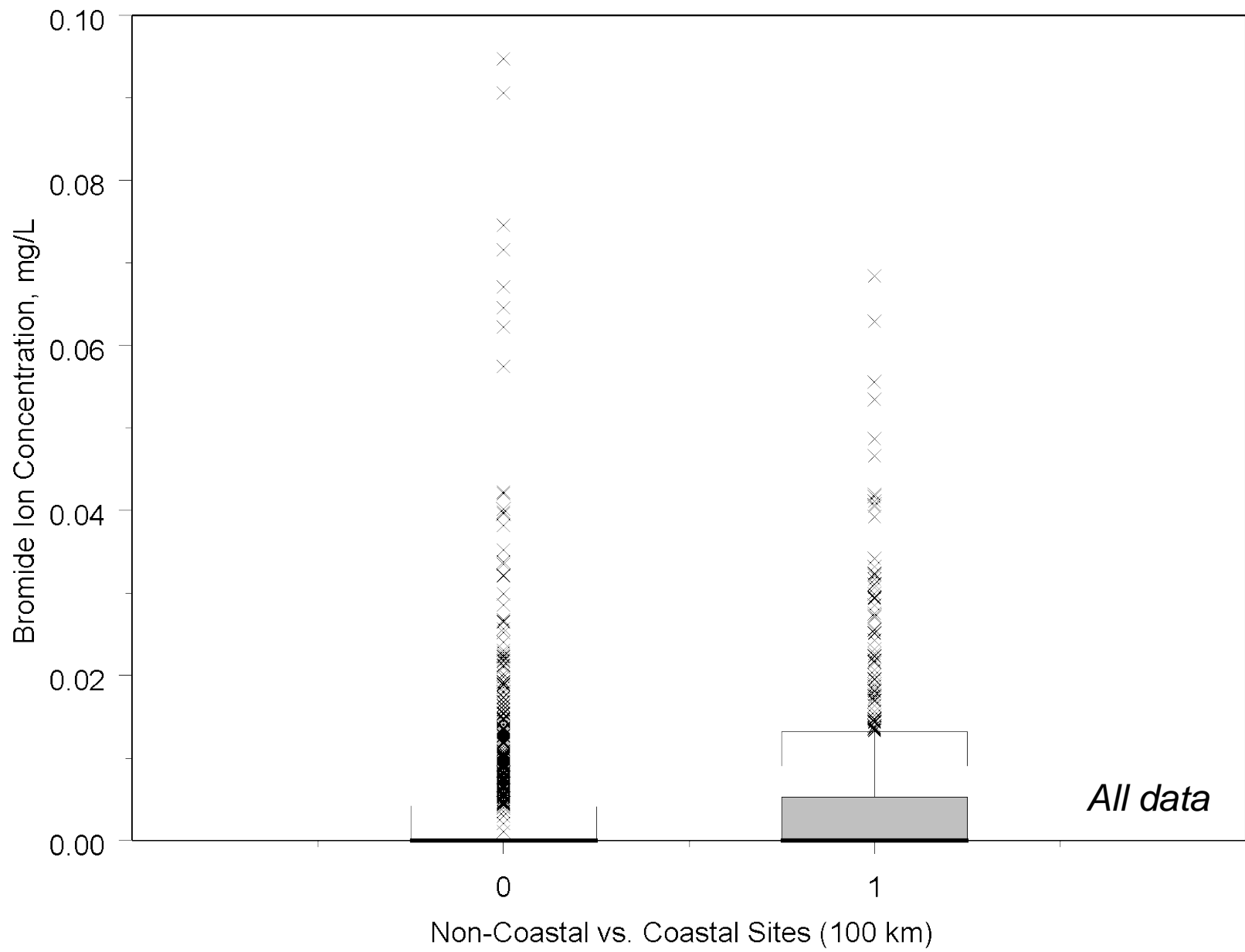


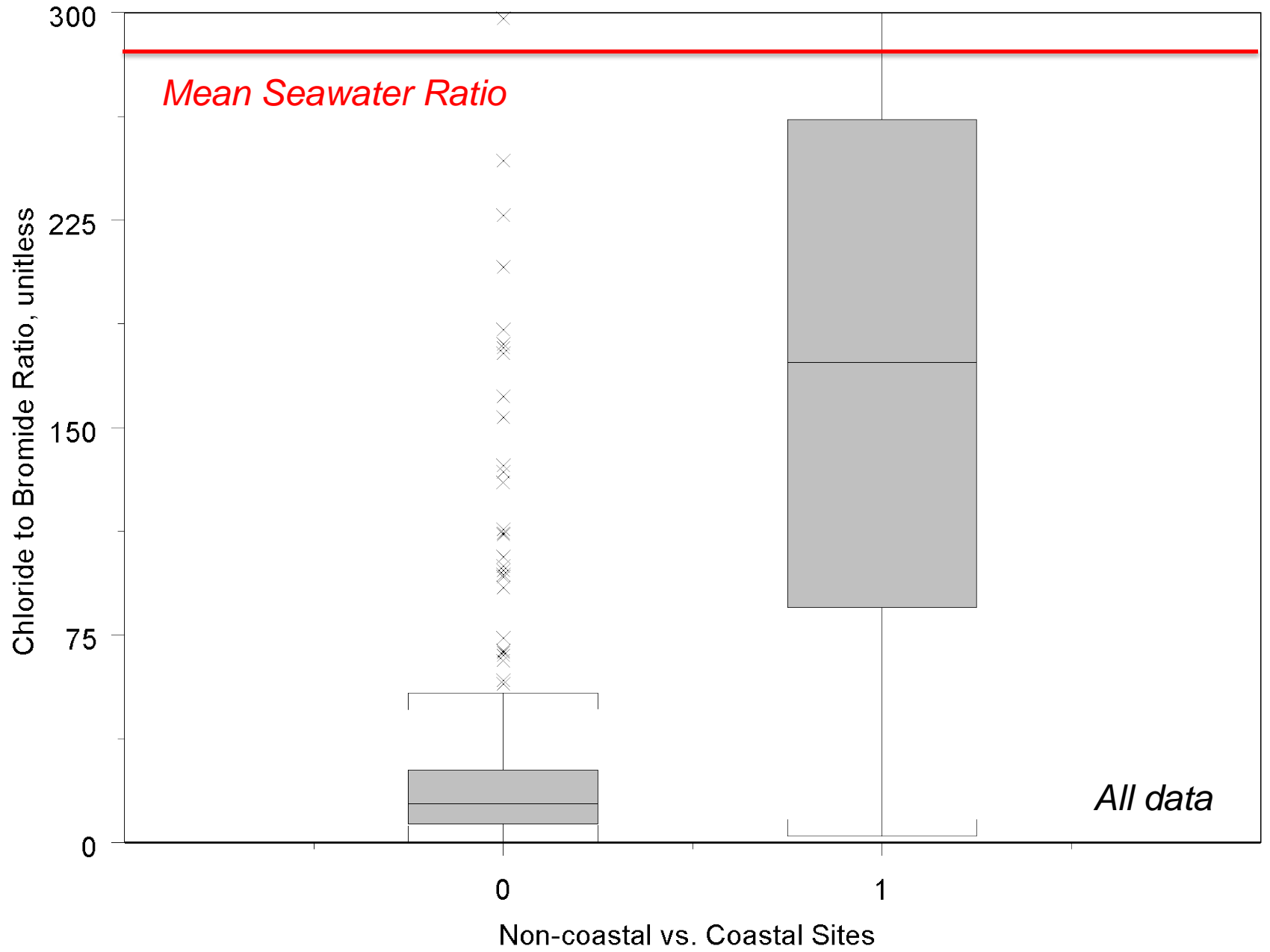
Map Of EPA Regions



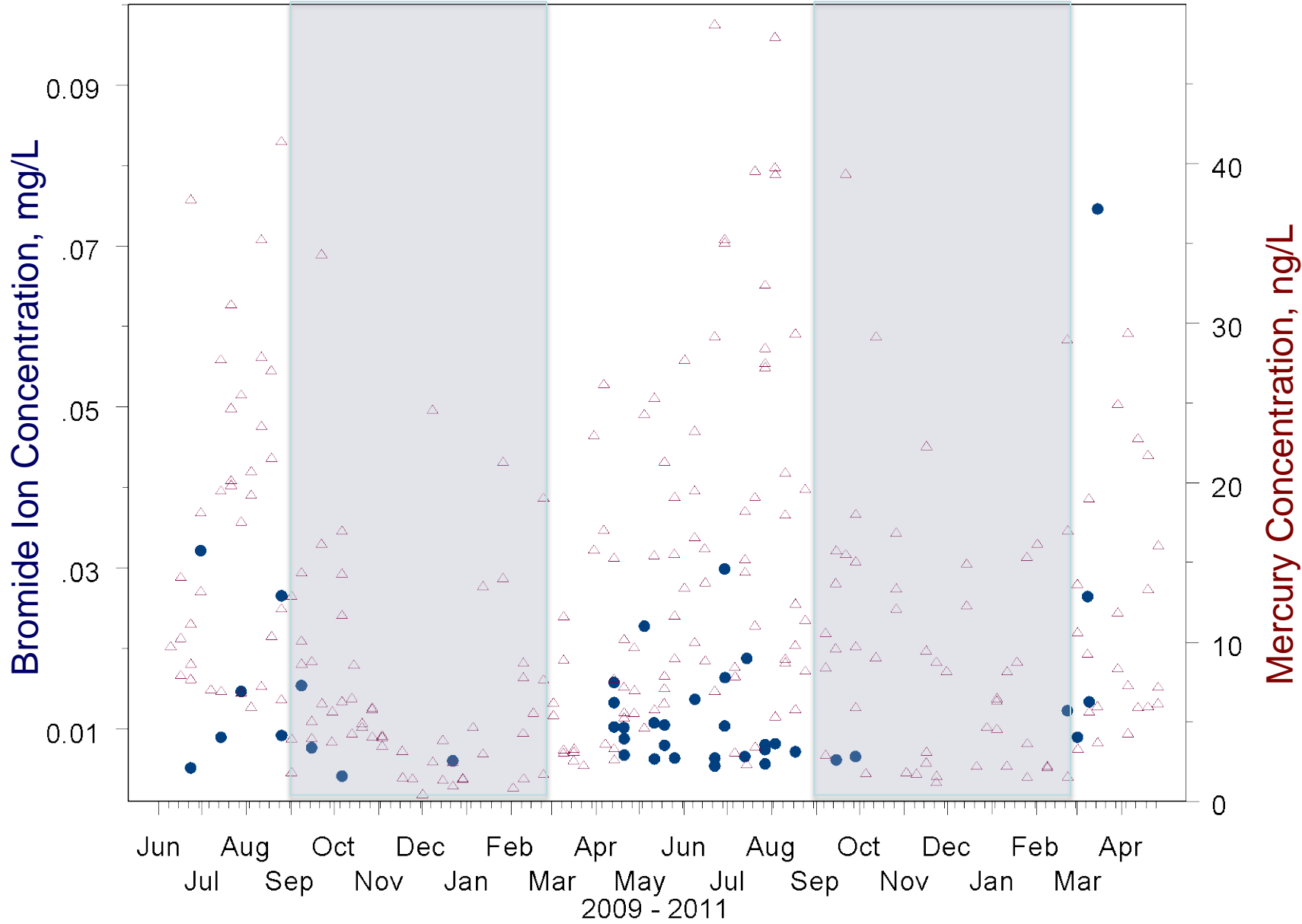
Data excluding n.d.



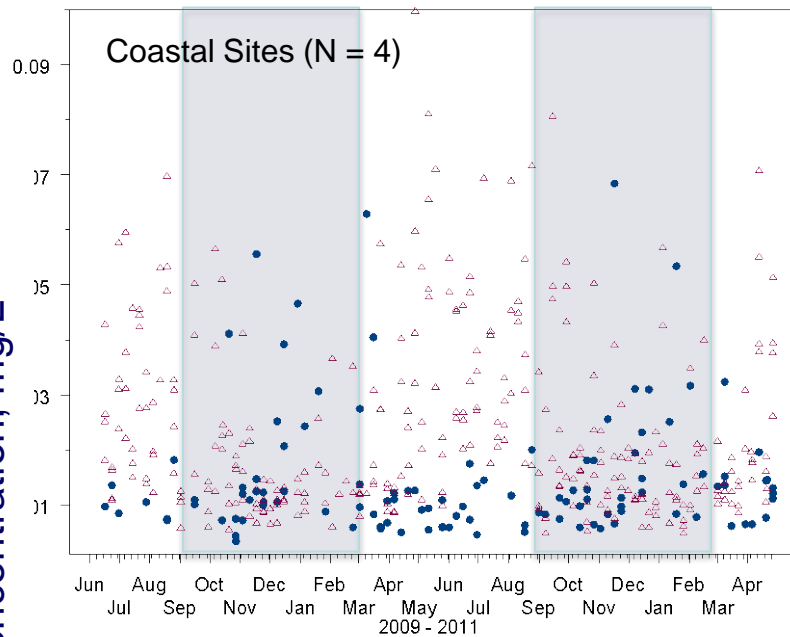




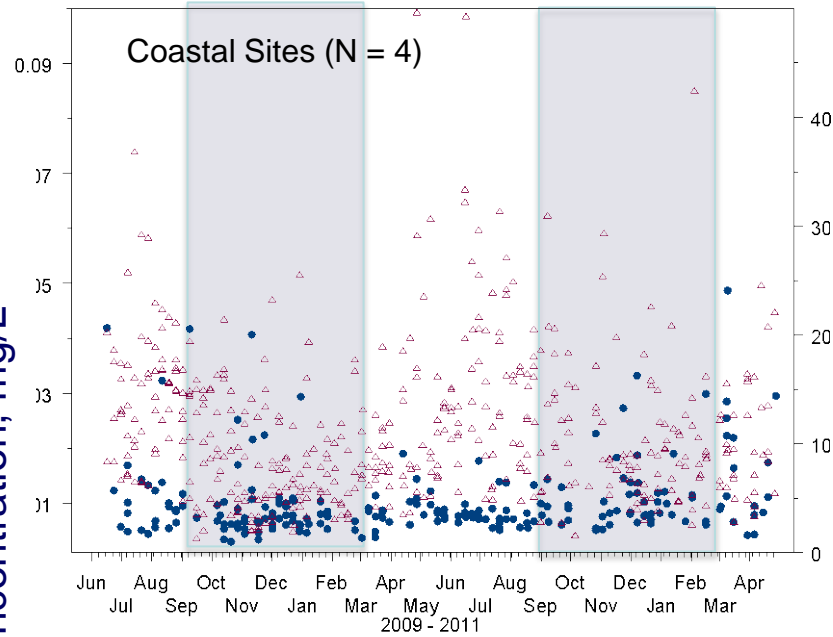
Map of EPA Regions



Region 1 (New England)



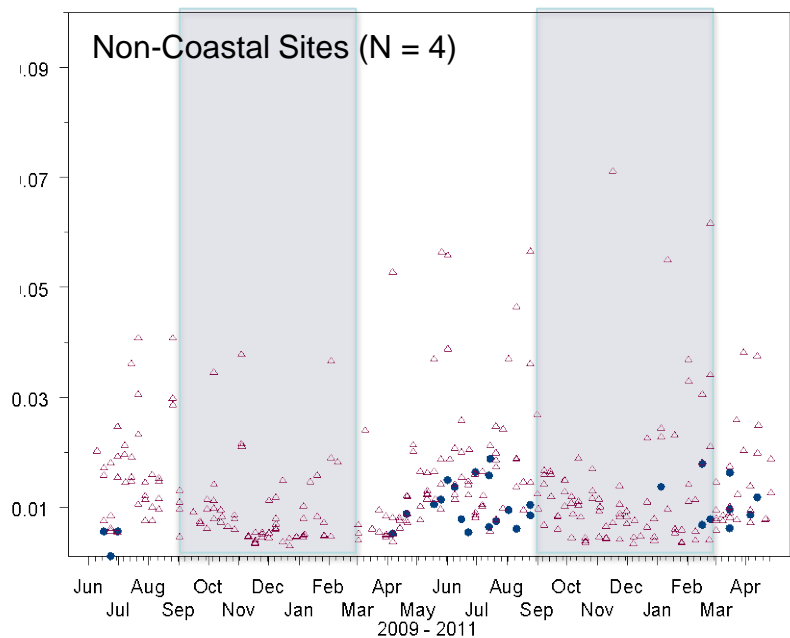
Region 4 (SE States)



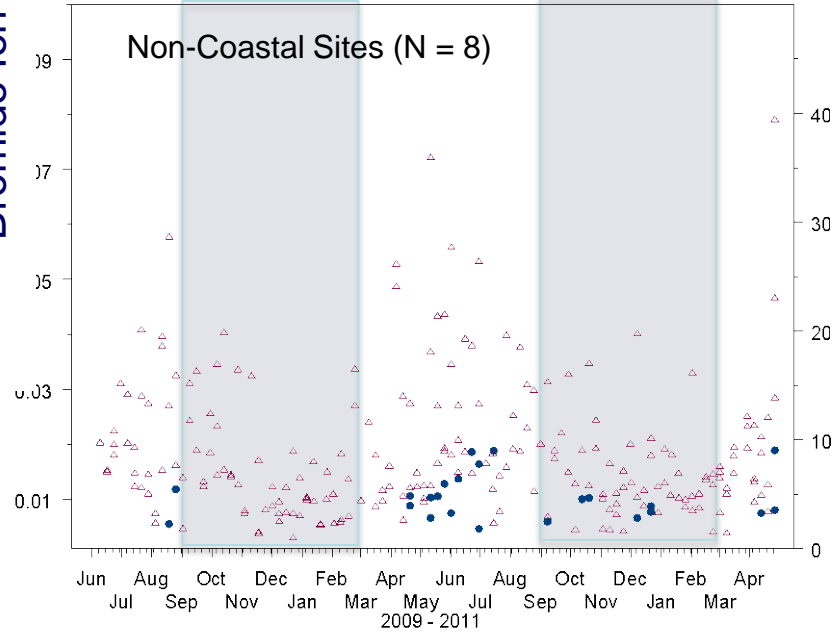
Mercury Concentration, ng/L

Bromide Ion Concentration, mg/L

Non-Coastal Sites (N = 4)



Non-Coastal Sites (N = 8)



Mercury Concentration, ng/L

Bromide Ion Concentration, mg/L

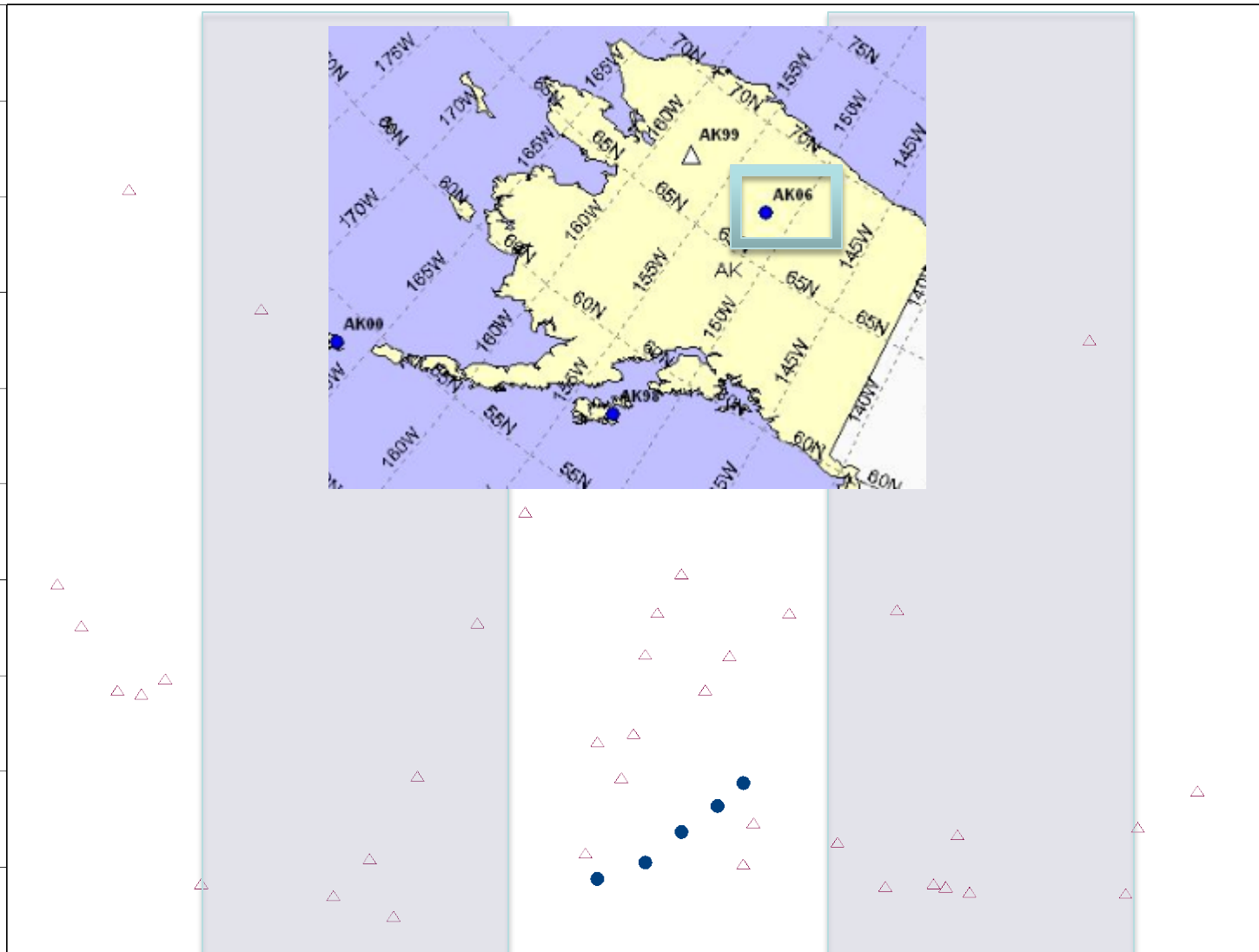
Bromide Ion Concentration, mg/L

0.09
0.07
0.05
0.03
0.01

Mercury Concentration, ng/L

20
15
10
5
0

Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar
2009 - 2011



In Conclusion....

- NADP rightly approved bromide as a new analyte for NTN & AIRMoN samples
- Bromide concentrations correlate with mercury concentrations seasonally, in a manner consistent with theory
- Bromide ion concentrations exhibit a distinct warm/cold seasonality

Acknowledgements

- Greg Wetherbee, USGS, for funding analysis of archive samples, and preparing 12-point plan for NADP approval of bromide as official analyte
- For data and information, contact:
 - clehmann@illinois.edu



National Atmospheric
Deposition Program